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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/621,464	07/18/2003	Wayne L. Johnson	071469-0304543	1154

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PILLSBURY WINTHROP SHAW PITTMAN, LLP  
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EXAMINER
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MACARTHUR, SYLVIA

ART UNIT	PAPER NUMBER
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1763

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
3 MONTHS	01/04/2007	PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

**Office Action Summary**

Application No.

10/621,464

Applicant(s)

JOHNSON ET AL.

Examiner

Sylvia R. MacArthur

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 04 October 2006.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1,2 and 4-36 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1,2, and 4-36 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 18 July 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |   |   |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)             | 4) <input type="checkbox"/> Interview Summary (PTO-413)                     |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)    | Paper No(s)/Mail Date. _____  |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date _____   | 6) <input type="checkbox"/> Other: _____                                    |

***Continued Examination Under 37 CFR 1.114***

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 10/4/2006 has been entered.

***Response to Arguments***

2. Applicant's arguments with respect to claims 1-36 have been considered but are moot in view of the new ground(s) of rejection as necessitated by the amendment to claims 1, 15, and 34 reciting that the match network having at least a portion comprising a first variable capacitor mounted to said workpiece support member lower surface within the chuck assembly so as to be in direct electrical communication with the workpiece support member lower surface. The prior art of Collins et al (US 5,210,466) teaches a match network 31 that comprises a plurality of variable capacitors C1 and C2 see col. 9 lines 30-65 and an inductor see col 10 lines 28-40 or the prior art of Pinneo teaches a match network 22 that features variable capacitors and inductors according to the paragraph adjoining cols. 9 and 10.

***Claim Rejections - 35 USC § 103***

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. Claims 1, 2, 7, 10-17, and 31-36 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kagatsume et al (US 4,908,095) in view of Collins et al (US 5,210,466) or Pinneo (US 5,902,563).

Regarding claim 1: Kagatsume et al teaches a vertically translatable chuck assembly for supporting a workpiece at different locations within a plasma reactor chamber having sidewalls surrounding an interior region, comprising: a chuck base (lower electrode 20) having a perimeter, an upper surface and lower surface; at least one support arm 10 and 72 extending outwardly from said perimeter to said sidewalls so as to support said chuck base within said interior region; a workpiece support member 21 having a lower surface and an upper surface capable of supporting the workpiece, arranged above said chuck base upper surface; and one or more vertical translation members lifter 19 arranged between and operatively connecting said chuck base and said workpiece support member for supporting and vertically translating said workpiece support member relative to said chuck base.

Kagatsume et al fails to teach a match network.

Collins et al teaches a VHF, UHF reactor system wherein a match network comprising variable capacitors C1 and C2 are mounted to the workpiece support member lower surface (the lower surface is within the chuck assembly). Note Fig. 1 and 2 illustrate that the match network is in direct electrical communication with the support member lower surface.

Collins et al teaches that the motivation for providing a match network is that the match network is used to eliminate any standing waves and subsequent losses from the input of the matching network and plasma inside the chamber see col 8 lines 9-19. Thus, it would have been

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network that is in direct electrical communication with the lower surface of the wafer support as Collins et al illustrates.

Likewise, Pinneo teaches a match network that is in direct electrical communication with the workpiece support member 16 as illustrated in Fig.1. Pinneo teaches that the motivation to provide the match network as taught is that an impedance match network provides an electrical impedance match between the output of the plasma generator and the vacuum electrical feed through. Thus, it would have been obvious for one of ordinary skill in the art at the time of the claimed invention to provide a match network in the plasma apparatus of Kagatsume et al as taught by Collins et al or Pinneo.

Regarding claim 2: An assembly according to claim 1, wherein one or more of said at least one support arm 10 and 72 is adapted to provide mechanical, fluid, electrical and/or pneumatic communication from outside the plasma reactor chamber to said chuck assembly, see col.7 lines 58-65.

Regarding claim 7: Kagatsume et al fails to specifically teach that one or more utility lines and ports pass through the support arm. However, col.9 lines 55-57 teach that arm 10 is extended into chamber 1 and a wafer W is sucked onto the arm 10. This teaching suggests that a utility port and line is provided in the arm to provide suction and ensure that the wafer remains attached to the arm during transfer. Thus, it would have been obvious for one of ordinary skill in the art at the time of the claimed invention to provide one or more utility lines and ports in the arm of Kagatsume et al.

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Regarding 10: An assembly according to claim 1, further including mechanical means (lifter 19) for vertically translating said workpiece support member relative to said chuck base, see col.5 lines 33-45 of Kagatsume et al.

Regarding 11: An assembly according to claim 10, further including a vertical drive motor 24e external to the plasma reactor chamber and in operable communication with said vertical translation members through one said support arm.

Regarding 12: An assembly according to claim 1, wherein said workpiece support member (lower electrode 20) includes one or more cavities (space 93 and 4 through-holes) adapted to receive and circulate cooling fluid within said workpiece support member, and further including a cooling system arranged external to the plasma reactor chamber and in fluid communication with said one or more cavities via one or more cooling fluid lines passing through one said support arm, see col. 5 lines 58-68.

Regarding 13: An assembly according to claim 1, The apparatus of Kagatsume et al further including bellows 27 connected at one end to lower surface of the workpiece support member, and at the opposite end upper surface of the chuck base, see col. 5 lines 52-64.

Regarding claim 14: An assembly according to claim 1, further including a control system 601 (see Fig.8) coupled to the vertical translation members for controlling their vertical translation of Kagatsume et al.

Regarding 16: A system according to claim 15, wherein said vacuum system includes a vacuum pump (150,151)and a gate valve 115 arranged between the chuck assembly and the vacuum pump of Kagatsume et al.

Regarding 17: A system according to 15, Kagatsume et al further includes a workpiece load chamber 13 with a sealable door (16a,b 18a,b) in communication with the interior region and arranged so that a workpiece can be placed into the interior region and onto the workpiece support member.

Regarding claim 34: A method of providing for uniform, substantially axially symmetric flow of plasma gas over a workpiece in a plasma reactor chamber having a central axis and capable of containing a plasma in an upper interior region of the chamber, comprising: supporting a chuck assembly within the reactor chamber with a plurality of support arms such that gas can flow around the chuck assembly from the upper interior region; arranging a vacuum pump system along the central axis adjacent the chuck assembly opposite the upper interior region, see abstract and col. 8 lines 31-45 of Kagatsume et al; providing the workpiece to the chuck assembly such that the workpiece is supported adjacent the upper interior region; flowing gas into the upper interior region and forming a plasma in the upper interior region; and activating the vacuum pump system (see col. 7 lines 31-45) so as to draw gas from the upper interior region over the workpiece and into the vacuum pump system.

Regarding claims 15, 35, and 36: Kagatsume et al teaches a plasma reactor system for processing a workpiece, comprising: a plasma reactor chamber having a central axis and sidewalls surrounding an interior region capable of supporting a plasma in an upper part of the interior region; a chuck assembly arranged adjacent said upper part of the interior region and along the central axis, the chuck assembly including: a chuck base having a perimeter, an upper surface and lower surface, at least one support arm extending outwardly from said perimeter to

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said sidewalls so as to support said chuck base within said interior region, a workpiece support member having a lower surface and an upper surface capable of supporting the workpiece, arranged above the chuck base upper surface, and one or more vertical translation members arranged between and operatively connecting said chuck base and said workpiece support member for supporting and vertically translating said workpiece support member relative to support said chuck base as discussed in claim 1 and a vacuum pump system (pumps 151 and 150). However, Kagatsume et al fails to teach that the pump is arranged adjacent said chuck assembly opposite said upper part and along the central axis. Modifying the apparatus of Kagatsume et al to change the location of the pump is an obvious matter of design. In that the essential elements of the apparatus exist and the location of the pump system would still function as taught by Kagatsume et al. Thus, it would have been obvious for one of ordinary skill in the art at the time of the claimed invention modify the apparatus of Kagatsume et al to be located as recited in claim 15. Note also that Collins et al according to Fig.1 has a pump 18 adjacent to the support assembly.

Regarding claims 31-33: The match network of Collins et al features variable capacitors C1 and C2 and at least an inductor. Collins et al recites that this configuration of a match network is low frequency or when there is a very short transmission line, see col. 10 lines 13-27. The match network of Pinneo includes variable capacitors and variable inductor (at least one) according to the paragraph adjoining cols. 9 and 10. Pinneo advises that this type of match network offers an enhanced impedance match between the output of the plasma generator and the vacuum electrical feedthrough. Thus, it would have been obvious to provide the match



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network of Collins et al or Pinneo in the apparatus of Kagatsume et al because they offer an enhanced impedance match to the reactor.

5. Claims 20-25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kagatsume et al (US4,908,095) and Collins et al (US 5,210,466) or Pinneo (US 5,902,563) as applied in claims 1,2, 7, 10-17, and 31-36 above, and in further view of Rossman et al (US 6,077,357).

The teachings of Kagatsume et al and Collins et al or Pinneo were discussed above.

Kagatsume et al and Collins et al or Pinneo fails to teach a cooling system in fluid communication with said workpiece support member via one or more cooling lines through said support arm.

Rossman et al teaches coolant channels 144,146 are received through the mass of the substrate support member 16. This channels and auxiliary cooling lines (utility is cooling fluid)are provide to facilitate heat transfer of the support. Thus, it would have been obvious for one of ordinary skill in the art at the time of the claimed invention to provide cooling lines through the support arm of the apparatus resulting from the teachings of Kagatsume et al as modified by Collins et al or Pinneo..

Regarding Claim 21: The apparatus of Rossman et al further including a gas supply system in pneumatic communication with said interior region, for supplying gas for forming the plasma.

Regarding claim 22: The apparatus of Kagatsume et al further includes a workpiece handling system in operable communication with said load chamber, for transporting wafers to and from said workpiece support member through the load chamber, see col. 7 line 58- col.8 line 14.

Regarding claim 23: The apparatus of Kagatsume et al further includes a plasma source generator arranged around the outside of the plasma reactor chamber so as to surround the upper part of the interior region, see Fig. 5

Regarding claim 24: The apparatus of Kagatsume et al further includes a control system 601 in electrical communication with said plasma source generator, said gas supply system, said cooling system, said RF power supply, and said vacuum system, for controlling the operation of the plasma reactor system.

Regarding claim 25: The apparatus of Kagatsume et al further includes further including a control system (controller 601) in electrical communication with said vertical translation members for controlling their vertical translation.

6. Claims 8 and 9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kagatsume et al (US4,908,095) and Collins et al (US 5,210,466) or Pinneo as applied in claims 1,2, 7, 10-17, and 31-36 above, and in further view of in view of Wang et al (US 6,537,011).

The teachings of Kagatsume et al and Collins et al or Pinneo were discussed above.

Regarding claim 8: Kagatsume et al fails to teach an assembly according to claim 7, wherein said one or more utility ports includes at least one of: a helium port, a nitrogen port, a thermocouple port, a current monitor port, a pneumatic push-pin supply port an electrostatic clamp port and a voltage probe port.

Wang et al teaches an apparatus for transferring and supporting a substrate wherein The support member 106 is provided with a temperature controlled base with suggested teachings of fluid channel, heating elements, and other temperature control members (e.g, thermocouples). Thus, it would have been obvious for one of ordinary skill in the art at the time

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of the claimed invention to provide the support member of the apparatus resulting from Kagatsume et al as modified by Collins et al or Pinneo with utility ports that will accommodate the suggested auxiliary process control equipment of col. 5 lines 1-9 of Wang et al. This improves the overall process control and uniformity of the process result.

Regarding 9: An assembly according to claim 7, wherein said utility lines are gathered into a flexible cable designed to accommodate vertical translation of said workpiece support member relative to said chuck base..

Wang et al is provided with element 102, which binds the lines from the support member and keeps them in one location for ease of maintenance.

*Allowable Subject Matter*

6. Claims 4-6,18,19, and 26 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

7. The following is a statement of reasons for the indication of allowable subject matter: the prior art fails to teach or fairly suggest regarding claims 4-6 a match network including a first inductor arranged adjacent the first variable capacitor within the chuck assembly between the chuck base upper surface and the workpiece support lower surface as recited in claims 4 and 26. The prior art of record further fails to teach or fairly suggest match network that resides between the workpiece support member and the chuck base as recited in claim 18.


8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Sylvia R. MacArthur whose telephone number is 571-272-1438.

The examiner can normally be reached on M-F during the hours of 8:30 a.m. and 5 p.m.

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Parviz Hassanzadeh can be reached on 571-272-1435. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

  
Sylvia R MacArthur  
Patent Examiner  
Art Unit 1763

December 26, 2006